



STUDY OF FEASIBILITY FOR ADOPTING TOUCHLESS FAUCETS, LOW FLOW AERATORS AND SENSOR URINALS IN ACADEMIC INSTITUTION, THANJAVUR, TAMIL NADU

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ABSTRACT

Objectives:

Today water is a scarce & precious commodity and it is emerging as a demand everywhere. Most of water is wasted when people don't turn off the faucet out of laziness or negligence. People leave water running, while brushing one's teeth or forgetting to shut the tap after the bathtub has been filled. To avoid wastage, sensors are fitted and the automatic operation of the sensors controls the wastage. This paper focuses on studies of the amount of water spent daily and reduces the consumption of water In order to save considerable amount of money as well as energy resources.

Methods/Analysis:

Drip calculators is a device installed, and it measures that a faucet releasing three drops a minute wastes appx 1 ml of water and more than 1.4 litres per day or approximately 511 litres per year. The adoption of automatic faucets, sensor urinals and low flow aerators make considerable amount of water savings as well as a cost -effective solution for water crisis. Equipped with motion sensors, automatic faucets only turn on and release water if a person is detected. Once the sensor determines that no one is in front, the valve closes automatically. In order to find the cost effectiveness, a Theatre in Trichy named as La cinemas have been studied.

Findings:

By installing these devices Initial cost is more but it's a better approach for effective water saving measures. The benefits of automatic faucets are not only limited to (i) Water conservation but also helpful for people with Mobility problems; (ii) Reduce the risk of disease transmission (iii) saving in water Cost and Energy Conservation. The finding focuses on eradicating the water demand in Academic institution and to estimate the total percentage of savings in water and to have healthy environment.

Applications/Improvement:

It can be practically adopted for urban and semi urban belt. The cost incurred for transportation and Diesel consumption can be minimized. Further this technique can be recommended in public buildings in order to have economical water system.

Key words: Energy Conservation, Water Consumption, Auto-faucets, Low flow aerators

Cite this Article: N. Koushik, C. Venkata Subramanium and D. Muthu, Study of Feasibility for Adopting Touchless Faucets, Low Flow Aerators and Sensor Urinals in Academic Institution, Thanjavur, TamilNadu. *International Journal of Civil Engineering and Technology*, 8(2), 2017, pp. 18–27.

<http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=8&IType=2>

1. INTRODUCTION

Touchless faucets, sensor urinals and low flow aerators consume less water than ordinary fittings. It saves considerable amount of water when taps are left open out of negligence. By using this we can save water, money, energy⁶. Usage of this technology prevents disease transmission and bacterial infections. Even though Automatic soap dispensers are a good idea for washing our hands and to keep our hands clean. This is the second thing people touch after relieving themselves from rest rooms². An automatic hand dryer eliminates the need for tissue paper and it is also touchless to use. It should not be projected four inches from wall because it became a hazard to the visually challenged peoples¹. It could save 10% of the cost of tissue papers. Tissue papers cannot be recycled after use, so hand dryers are a much more environmentally friendly choice⁴.

Generally touchless restroom is easy to maintain in terms of cleaning, housekeeping charges, failure of taps etc. also the amount of waste generated from tissue papers and consumption of resources is reduced³. There are also inexpensive green cleaners available in the market which will not affect the environment but kills bacteria. In a conventional rest room more chemicals and anti-infectants are used compare to touchless restrooms⁵. Chemicals and acids are toxic and corrosive in nature. Bleaching powder and other traditional cleaners affect the efficiency of bio-gas plant because these chemicals kill the bacteria that are used for producing methane gas. These are healthier for people who have asthma, allergies and sensitive to conventional cleaning products⁷. A restroom that minimizes disease transmission will make our campus healthier place for students and faculty by curtailing communicable diseases⁶.

2. MATERIALS AND TECHNOLOGY

2.1. Low Flow Aerators



Figure 1 Low flow aerators for Sensor taps



Figure 2 Installation of low flow aerators

It saves water up to 75% of water reducing the rinse ability. It reduces the amount spent on water bills. There-fore obviously less water usage results less load on recycling plant and pumping cost. Aerators are suitable for homes, flats, offices, institution buildings, school, colleges, restaurant, hotels, hostels, hospitals & airports. Flow rate 4 (lpm) Litres Per Minute.

2.2. Touchless Faucets



Figure 3 Touchless faucets



Figure 4 Sensor Faucets

The sensor faucets do not have simultaneous hot & cold handles/knobs, so they are usually installed to be used with cold water only, or with an optional mixing valve, which fits under the sink/wash basin. The "touch- free" eliminates a major source of contamination of germs and is therefore hygienic to use. It's huge Water-Saving works on Dual Power (Battery or AC Mains Plug-In) Sensor Faucet with Automatic Turn-On & Shutoff upon removal of hands from the sensor proximity. All mechanical and electrical components are contained in one covered controlling box to be fixed below the wash basin for easy installation. Operating Temperature:0-75 degree Celsius. Can be

Powered with 4 AA Alkaline Batteries (Not Included) or 220volts AC Mains Electrical Outlet. For best long lasting results use dura cell AA Size Batteries.

2.3. Auto flush Urinal



Figure 5 Infrared urinal flushers

Based on the international advanced solenoid valve technology, setting the closure, filtering functions in the entire copper valve. Low energy consumption, battery operated and the life of battery more than 50,000 cycles. It is suitable to airports, bus station, office building and hospitals, public places especially.

3. EXPERIMENTAL ANALYSIS



Figure 6 Measuring normal faucet water consumption per minute

- No. of wash room faucets in Department blocks - 299
- No. of wash room faucets in Boys Hostels -204
- No. of wash room faucets in Girls Hostels - 172
- Total wash room faucets required - 675
- No. of Urinal flushers in Department blocks and Boys Hostel – 397
- Cost of one Auto flusher – 4600 (including installations)
- Cost of one Touchless faucet - 3400 (including installations)
- Cost of a low flow aerator - 190
- Total cost for adopting low flow aerator - 1,28,250
- Total cost for adopting Touchless faucets – 22,27,500
- Total cost for adopting Auto flushers – 18,26,200

Study of Feasibility for Adopting Touchless Faucets, Low Flow Aerators and Sensor Urinals in
Academic Institution, Thanjavur, Tamil Nadu

- Total Built up Area - 21 lakhs sq ft

A brief experimental analysis has been undergone to check the feasibility of replacing the normal taps and urinals with sensor taps and urinals in our campus. The numbers of faucets and urinals data have been collected and the cost incurred for installing new component has been found out. Also the cost for further damages and repairs has been added to check its practicality.

Table 1 Departmental Buildings Water Usage Details

S.No	Department Buildings	Wash Rooms	Urinals
1.	Training and placement	8	16
2.	MCA Block	8	15
3.	School of Computing	14	20
4.	Research labs for computing	10	13
5.	A Hub for Research and Innovation Phase - 1	16	16
6.	Research Centre for Nanomaterial	16	16
7.	School of Mechanical Engineering	42	36
8.	School of Electrical and Electronics Engineering	24	22
9.	School of Chemical & Biotechnology	46	32
10.	School of Civil Engineering	22	60
11.	Law & MBA Block	30	32
12.	Central Library	8	16
13.	Central Animal house	5	-
14.	Polytechnic Block	50	15
15.	Total	299	309

Table 2 Boys Hostel Water Usage

S.No	Boys Hostel	Wash Rooms Faucets	Flushers
1.	Block 1	48	6
2.	Block 2 (4 in 1)	48	22
3.	Block 3 (3 in 1)	12	-
4.	Block 4 (4 in 1)	32	16
5.	Block 5 (4 in 1)	16	36
6.	Block 6 (4 in 1)	8	8
7.	Block 7	16	-
8.	Block 8	12	-
9.	Block 9	12	-
	Total	204	88

Table 3 Girls Hostel Water Usage

S.No	Girls Hostel	Wash Rooms Faucets
1.	Block 1 (4 in 1)	8
2.	Block 2 single	24
3.	Block 3 (4 in 1)	12
4.	Block 4 (2 in 1)	32
5.	Block 5 (4 in 1)	24
6.	Block 6 (5 in 1)	12
7.	canteen	60
	Total	172

Table 4 Source of Water Consumption and its Daily Cost

S.No	Source lt/day	Total Quantity of Water consumption (liters/ day)	Cost/day
1	Tanker Lorry	98,000	1,90,425.00
2	TWAD Board	423166.67	3,42,432.00
3	Bore Well	3,07,300	2,62,000
	Total	8,28,466.67	7,94,857

Table 5 Pumping of Water from Different Points and its Electricity Cost

S.No	Bore Points	Pumping (hours/day)	Electricity cost/day
1	Block 1	6	420
2	Block 2	2.5	175
3	Block 3	6	420
4	Block 4	1.5	105
5	Block 5	4.15	294
6	Library	1.45	105
7	Block 6	3	210
8	Computing Block	1.45	105
9	Canteen	3	210
10	Civil Block	1.5	105
11	Electrical Block	3	210
12	Chemical Block	3	210
13	Electronics Block	2.5	175
14	Animal House	1	70
15	Research Block	0.45	40
16	Research Block 2	1.5	100
17	Block 7	6	420
18	Block 8	5	350
19	Block 9	2	140
20	Hostel 1	4	280
21	Hostel 2	4	280
22	Hostel 3	7	490
23	New Hostel	4	280
24	Kitchen Tank	7	735
25	Total	81	5,929

4. RESULTS AND DISCUSSION

In order to find the cost effectiveness, a Theatre in Trichy named as La cinemas have been studied. Where they have adopted touchless faucets and sensor urinals after renovation of the building. The technology has been successfully for past 2 years without any defects.

Table 6 Cost Analysis for Departmental Buildings on Wash Room Faucets

Departmental Blocks		
Description	Ordinary Faucets	Touchless Faucets
Litres per tap per day	225	87.5
Hours of usage per tap per day	2	2
Days per year	180	180
Annual water usage (litres)	7,62,48,000	6,38,45,000
Reduce annual water usage by	-	1,24,03,000
Annual water cost*	7,31,98,080	6,12,91,200
Annual savings*	-	1,19,06,880

Table 7 Cost Analysis for Departmental Buildings and Boys Hostels on Infrared Flushers

Description	Manual Urinal flushers	Sensor Urinal flushers
Liters per flush	1.5	0.5
Flushes per hour	4	4
Hours per day	6	6
Water usage per day (ltrs)	3,573	1,191
Water usage per year (ltrs)	10,71,900	3,57,300
Water savings per year (ltrs)	-	7,14,600
Annual water cost	10,29,024	3,43,008
Annual water cost saving	-	6,86,016

Table 8 Cost Analysis for Boys and Girls Hostels on Wash Room Faucets

Male Taps		
	Ordinary Faucets	Touchless Faucets
Litres per minute	9.75	3.5
Hours of usage per tap per day	6	6
Days per year	300	300
Annual water usage (litres)	35,80,200	12,85,200
Reduce annual water usage by	-	22,95,000
Annual water cost*	34,36,992	12,33,792
Annual savings*	-	22,03,200
Female Taps		
	Ordinary Faucets	Touchless Faucets
Litres per minute	9.75	3.5
Hours of usage per tap per day	6	6
Days per year	300	300
Annual water usage (litres)	30,18,600	10,83,600
Reduce annual water usage by	-	19,35,000
Annual water cost*	28,97,856	10,40,256
Annual savings*	-	18,57,600

Especially water scarcity is frequent in our campus located at Thanjavur, Tamil Nadu. Though we get water from TWAD Board, Tanker lorry and adopted rain water harvesting system for every building, we couldn't trap sufficient quantity of water from the bore wells. So we planned to adopt touchless taps and low flow aerators, which can reduce flow rate per min and prevent further wastage of water. In order to satisfy the high demand during summer, we are forced to buy water from private lorry. This adds up more cost on water bills. Further we could save thousand seven eighty rupees per day on fuel cost and yearly three lakhs fifty-six thousand. The accuracy of water usage can be precisely measured and recorded by using water meter in every building. The practicality of adopting smart water system also been considered for the damages and repairs due to breakages because of the playful nature of students. Students can be given demo for how to use the products, to have efficient operation. Slowly this becomes a usual for them and nothing new.

Table 9 Water Consumption Comparison for Normal Installation and Smart Installation

Faucets	Before Installing	After Installing	Water Savings
	Liters / year	Liters / year	Cost / year
Departmental Building	7,62,48,000	6,38,45,000	1,24,03,000
Boys Hostel	35,80,200	12,85,200	22,95,000
Girls Hostel	30,18,600	10,83,600	19,35,000
		Total	1,66,33,000
Urinals	Before Installation	After Installation	Water Savings
	liters / year	liters / year	Cost / year
Departmental Buildings	5,00,580	1,66,860	3,20,371.20
Boys Hostel	5,71,820	1,90,440	3,66,124.76
		Total	6,86,468.96

Table 10 Cost Comparison with Normal Installation and Smart Installation

Faucets	Before Installing	After Installing	Total Savings
	liters / year	liters / year	cost / year
Departmental Building	7,31,98,080	6,12,91,200	1,19,06,880
Boys Hostel	34,36,992	12,33,792	22,03,200
Girls Hostel	28,97,856	10,40,256	18,57,600
		Total	1,39,84,800
Urinals	Before Installation	After Installation	Total Savings
Description	Cost in rupees/year	Cost in rupees/year	Cost in rupees/year
Departmental Buildings	4,80,556.80	1,60,185.60	3,20,371.20
Boys Hostel	5,48,947.20	1,82,822.44	3,66,124.76
		Total	6,86,495.96

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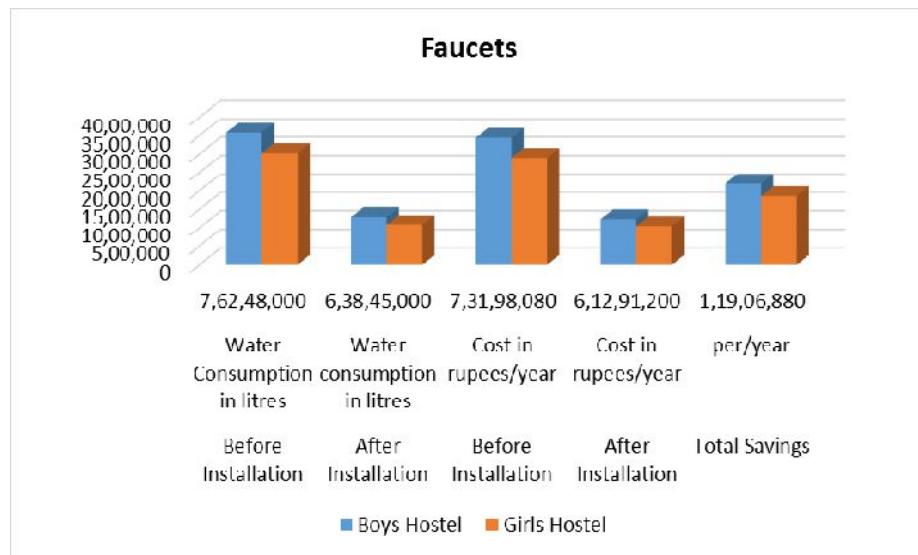


Figure 6 Graph showing comparison of old and new Faucets adoption

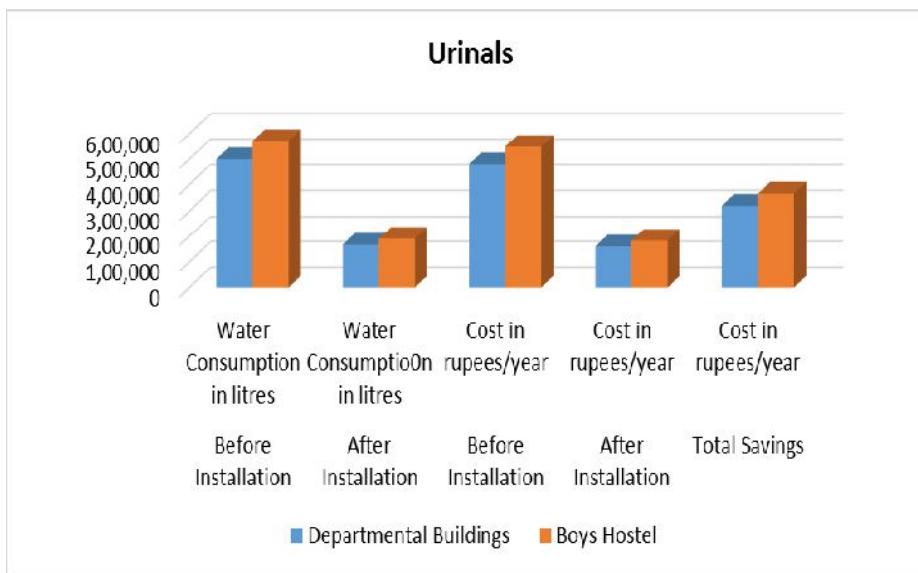


Figure 7 Graph showing comparison of old and new urinals adoption

5. INFERENCE

Cost incurred for installing smart water system is forty-two lakhs and eighty-two thousand rupees and a sum of one lakh thirty thousand rupee is added for further damages and defects. The total cost of savings per year is one crore forty-eight lakhs and ninety-two thousand rupees and percentage of savings in water consumption comes around 23.25% If the amount of water wasted by a person for daily routine activities is calculated say Brushing, Shaving etc. The cost savings could be more than the standards. Antimicrobial restrooms are the way of the future. Adoption of this technology also reduces considerable amount of fossil-fuel consumption and ultimately prevents entry of green-house gases into atmosphere. Though the installation cost of automatic faucets, sensor urinals and low flow aerators urinals exceed those of traditional counterparts, the cost is less in terms of wages to a cleaner and it is easier to maintain the restroom. Thus, it is strongly recommended to adopt low flow aerators, sensor urinals and auto faucets for our campus to stay healthy and prevent communicable diseases.

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